

## Section 5: Recent Supply and Demand Forecasts

### *Short-term supply-demand and price forecast*

High gas prices during the summer and fall of 2003 were in part caused by the need to make up for the huge draw down of natural gas storage during the winter of 2002-03, which resulted in near record low gas storage levels. As storage levels climbed back into the five-year average range during the summer and fall of 2003, natural gas prices on the 2- to 24-month futures market gradually fell about 20 percent from the peak levels in May and June 2003. A combination of reduced demand and incremental supply increase accounted for the improved gas storage and price situation in late 2003. Moving into 2004, a recovering economy and high oil prices put some upward pressure on gas price.

The Energy Information Administration (EIA) forecast that U.S. production would rise by 1 to 2 percent in 2003 and by about 1 percent in 2004 and 2005.<sup>1</sup> Demand was estimated to be down 3 percent in 2003 relative to 2002, and forecast to rise about 2 percent in 2004 and 1 percent in 2005. The EIA forecasts a continuing tight balance between supply and demand through 2005, which is corroborated by the natural gas futures market where gas is being bought and sold at around \$5 to \$6/MMBtu through 2005.

### *Long-term supply forecasts*

For this report we reviewed the five national natural gas supply studies shown below.

1. National Petroleum Council (1999): *Natural Gas – Meeting the Challenges of the Nation’s Growing Natural Gas Demand*.
2. Energy Information Administration (2001): *U.S. Natural Gas Markets – Mid-term Prospects for Natural Gas*.
3. California Energy Commission (2003): *Preliminary Natural Gas Market Assessment*.
4. National Petroleum Council (2003): *Balancing Natural Gas Policy - Fueling the Demands of a Growing Economy*.
5. Energy Information Administration (2004): *Annual Energy Outlook 2004*.

The supply forecasts span the time frame from late 1999 to early 2004, a period that includes two significant gas price spikes and the West Coast energy crisis. The forecasts rely on many of the same data sources,<sup>2</sup> differing primarily in the dates when the data was assembled. Model design, scenario criteria, and assumptions do differ between the forecasts. Of particular interest is how the North American supply and price forecasts have evolved over the five-year period covering the reports. A brief summary of each report is provided below.

---

<sup>1</sup> Lehman Brothers in their quarterly survey of gas producers estimated a 1.6 percent decline in 2003 U.S. production and forecast a 1-2 percent decline in 2004 (Natural Gas Week, Feb. 16, 2004). EIA recently saw their forecast of a 2 percent production increase for 2003 evolve into to a 0.5 percent actual increase.

<sup>2</sup> All of the reports rely on data from the GPC, USGS and MMS for their analyses. In addition the CGPC and NEB provide some of the information on Canadian resources and production. Several energy-consulting firms also provide information and modeling input.

National Petroleum Council (1999): *Natural Gas – Meeting the Challenges of the Nation’s Growing Natural Gas Demand*.

The NPC noted that during the 1990s gas demand growth had outpaced the central estimate of their 1992 natural gas report. The more rapid growth in gas demand was attributed to the higher than anticipated economic growth rate of the 1990s, the competitive price of natural gas, and its clean burning attributes. Natural gas demand at the national level was forecasted to grow to 29 Tcf in the year 2010, and 31.3 Tcf by 2015. Growth in electric power generation was predicted to account for 47 percent of the increase in gas demand.

Technological advances, an adequate supply of skilled workers, and more drilling rigs, were seen as necessary to continue development of more difficult non-conventional gas resources. Increased access to natural gas reserves in restricted areas was also seen as critical to supply growth.

Energy Information Administration (2001): *U.S. Natural Gas Markets – Mid-term Prospects for Natural Gas*.

The first section of the EIA report focused on recent growth in natural gas demand and the marked run up in gas prices during 2000-2001. The report cited high gas demand in 1999-2000, low gas storage levels,<sup>3</sup> and a cold winter as the principal causes of the 2000-2001 natural gas price spike.

The EIA forecast total gas supply being 31.7 Tcf in 2015. U.S. production<sup>4</sup> was projected to be 26.3 Tcf in 2015, with a market price of 3.07 \$/MMBtu (2000 dollars). The EIA report examined the possible impact of several critical factors on natural gas supply and price. These factors included rapid resource depletion,<sup>5</sup> access limitations to gas resources on federal lands, a national carbon dioxide emission limitation, and variable LNG costs.

California Energy Commission (2003): *Preliminary Natural Gas Market Assessment*

The CEC report focuses on the West Coast and was developed as the most recent natural gas price spike began to emerge in late 2002. This report had a noticeably different tone from the earlier gas supply reports, but predicted that supplies of natural gas, though more costly, would be sufficient through the 2003 to 2013 time frame that CEC examined. Growth in U.S. gas production was forecast to be incremental, and it was expected that the nation would become more reliant on Canadian natural gas imports and possibly LNG.

---

<sup>3</sup> The EIA reported low storage levels at the end of the refill season – 2,732 Bcf at end of October, the lowest level since 1976. A cold winter drew the already low storage down to a very low 742 Bcf by the end of the 2000-01 heating season

<sup>4</sup> EIA forecasts no significant increased production from Alaska until 2018.

<sup>5</sup> Aspects of the rapid resource depletion scenario were incorporated into the EIA’s *Annual Energy Outlook 2004* report.

Market volatility, due to the close balance between gas supply and demand, would result in occasional price spikes and potential demand destruction in the industrial sector.

Natural gas supply for the United States was projected at 29.4 Tcf in 2013 with 21.8 Tcf from U.S. production with an average wellhead of \$3.71 (year 2000) in 2013.

National Petroleum Council (2003): *Balancing Natural Gas Policy – Fueling the Demands of a Growing Economy*.

In response to the recent spike in natural gas price the energy secretary in March of 2003 asked the National Petroleum Council to update its 1999 natural gas supply and demand market assessment and make summary findings available by October 1, 2003. The 2003 NPC natural gas report begins by acknowledging that the gas market had fundamentally changed since the 1999 report, and that a wide range of policy actions would be necessary to maintain adequate supplies and keep natural gas prices at an acceptable level. The NPC presented “Reactive Path” and “Balanced Future” scenarios. The Reactive Path assumed a continued tight balance between gas supply and demand due to policies that promoted consumption and limited production. Gas prices for this scenario remain in the \$5 to \$6/MMBtu range, which as a consequence reduces long-term natural gas demand.

The Balanced Future was the preferred scenario and emphasized action in the following policies areas to moderate prices.

- **Demand reduction:** Greater emphasis on efficiency and conservation, both in direct use of natural gas and in electricity. Some demand destruction will continue in the industrial sector as energy intensive industries relocate outside of North America.
- **Supply growth:** Increasing access to U.S. resources that currently cannot be developed. Promote development of large-scale resources such as LNG and Arctic natural gas.
- **Infrastructure:** Promote timely development of infrastructure and reduce regulatory and financial barriers to establishing long-term gas contracts.
- **Markets:** Promote development of physical and risk management tools to moderate the effects of price volatility.

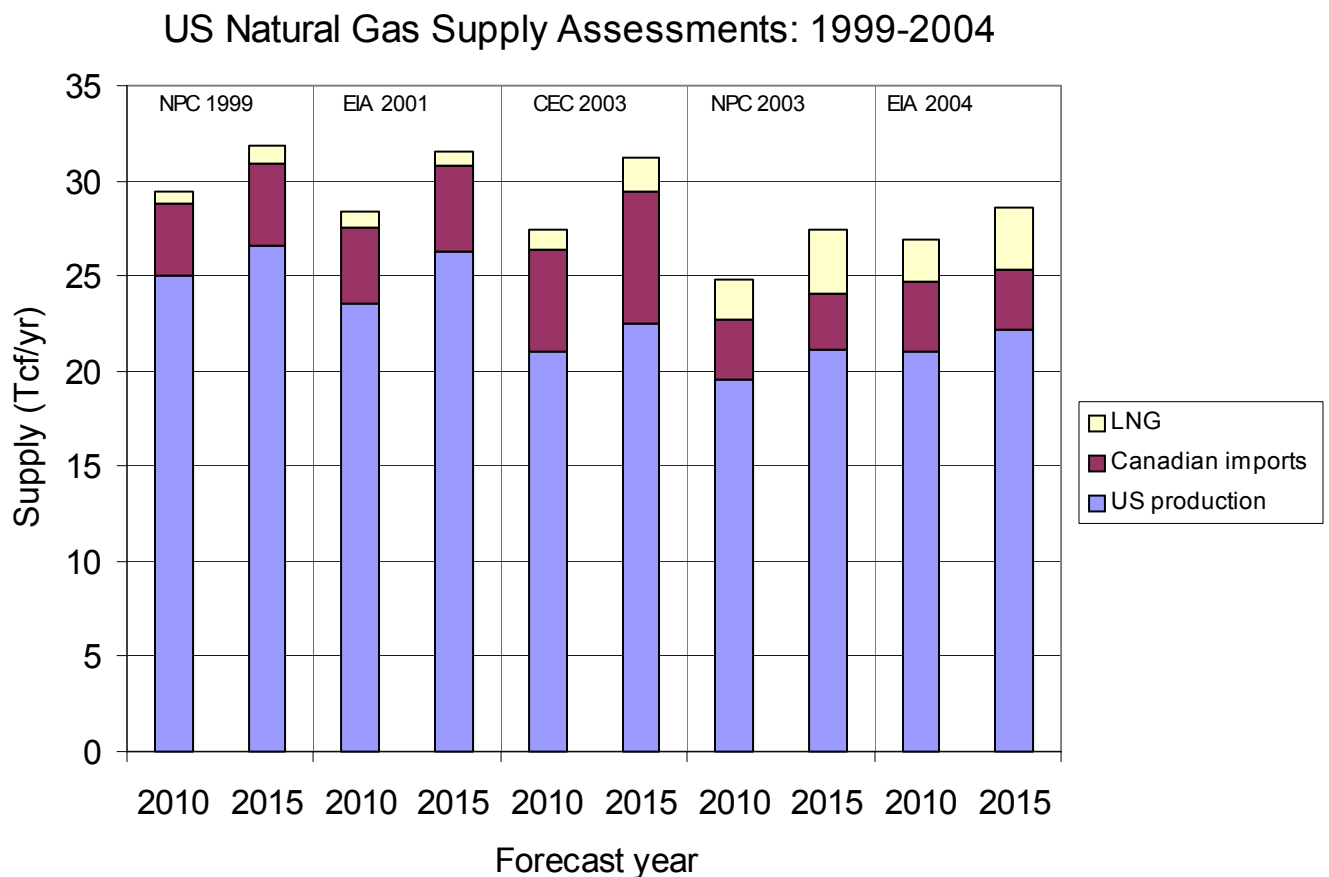
Under the Balanced Future scenario, annual U.S. demand is forecast at just under 27 Tcf in 2015, with approximately 21 Tcf coming from U.S. production, including over 1.5 Tcf coming from Alaska via pipeline (completion in 2013-14). Wellhead prices are forecast to be in the high \$3 to low \$4/MMBtu range.

Energy Information Administration: *Annual Energy Outlook 2004*.

The EIA introduced its *Annual Energy Outlook 2004* report by noting that over the last four years natural gas prices had remained substantially higher than during the 1990s and had significantly exceeded previous EIA near term forecasts for the 2000-04 period. Accordingly, the EIA stated “this has led to a reevaluation of expectations about future

trends in natural gas markets, the economics of exploration and production, and the size of the natural gas resource.” Building on similar baseline data used by the NPC, the EIA made a large downward revision from its 2001 U.S. natural gas supply forecast.<sup>6</sup> The EIA 2004 *Annual Energy Outlook* forecast U.S. supply at 28 Tcf in 2015 with U.S. production<sup>7</sup> contributing 21.7 Tcf. The 2004 EIA forecast represents a 12 percent reduction in U.S. consumption and a 20 percent reduction in U.S. production relative to the 2001 forecast. Average wellhead price was forecast to be \$4.14/MMBtu in 2015.

The U.S. supply forecasts presented in the five reports are summarized in Figure 5.1 below.



**Figure 5.1: Summary of natural gas supply forecasts for 2010 and 2015**

\* CEC 2008 and 2013 supply and price values extrapolated to 2010 and 2015. Note that some combinations of production and imports don't add up to total supply, as exports to Japan and Mexico are not included.

### ***Supply and Demand Reassessment***

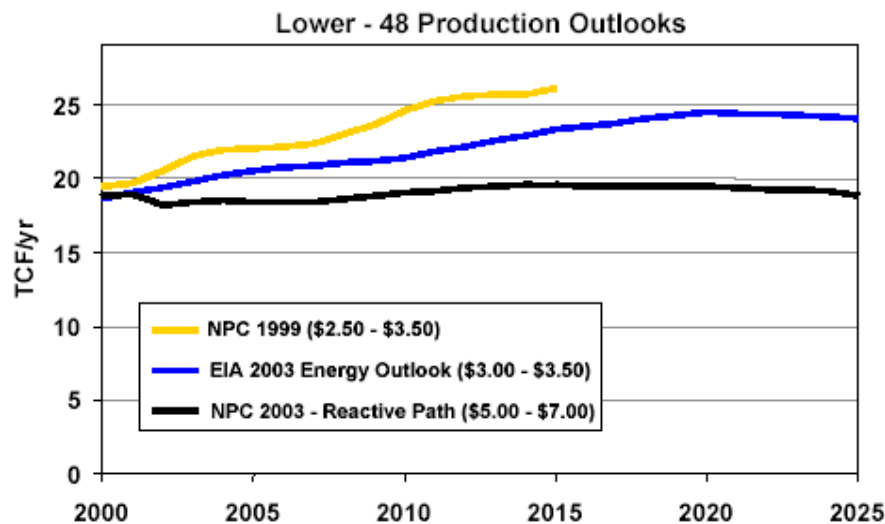
Over the last several years there has been an evolution in the supply (production and imports) forecasts produced by the EIA, NPC and other entities. The early NPC (1999) and

<sup>6</sup> The EIA also made an initial downward revision for U.S. gas supply in the 2003 *Annual Energy Outlook*.

<sup>7</sup> No significant Alaska production in the EIA supply forecast: Pipeline completion date estimated as 2018.

EIA (2001) reports are similar, both forecasting significant increases of approximately 40 percent in overall supply and U.S. production during the 2000 to 2015 time period. Within a year after its release the 1999 NPC report came under considerable criticism for underestimating demand growth, particularly in the power generation sector, and for overestimating future productive capacity in the conventional U.S. gas basins (Natural Gas Weekly, 2003).<sup>8</sup>

As Figure 5.1 above illustrates, the 2003 NPC and 2004 EIA reports represent a significant reassessment of the North American natural gas supply outlook. The NPC natural gas study shows a large downward revision in forecasted natural gas supply relative to the earlier NPC report: Forecast annual U.S. demand in 2015 is reduced by approximately 4 Tcf, while the forecast for total U.S. gas production is diminished by nearly 5.5 Tcf. Even more remarkable is that the forecast for Lower 48 production in 2015 has been reduced by more than 6.5 Tcf/year in the more recent report. Canadian production forecasts were also diminished in the 2003 NPC report.<sup>9</sup> The NPC report also makes an upward revision in forecasted gas prices, drilling activity, and the volumes of future LNG imports. The revisions between the 2001 and 2004 EIA reports for U.S. supply and production are similar to the revisions made by the NPC. Figure 5.2 below further illustrates the recent downward revision in the forecasted natural gas production for the Lower 48.



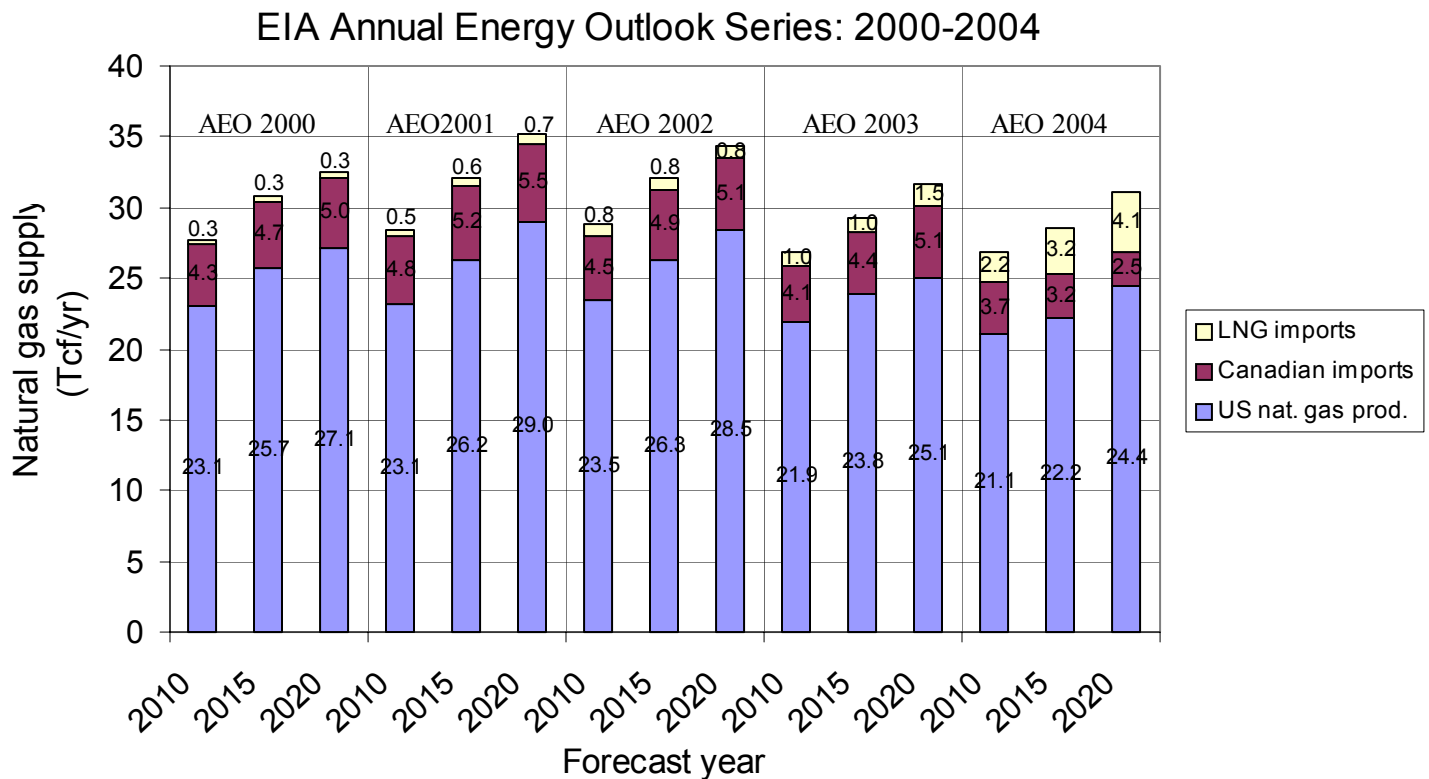
**Figure 5.2: Reassessment of future Lower 48 natural gas production** NPC, 2003

The EIA in its 2003 and 2004 *Annual Energy Outlook* (AEO) reports has significantly reduced the forecasts for total U.S. gas supply and production relative to the 2001 EIA report. The AEO 2004 report presents a 2015 forecast with overall gas supply revised

<sup>8</sup> The 1999 NPC report forecast an additional 2.7 Tcf/year of production from the Gulf of Mexico, while a more recent analysis by the Minerals Management Service (MMS) forecast a 1.7 Tcf/year decline in production by 2010.

<sup>9</sup> The 2003 NPC Canadian production forecast of 6.6 Tcf/year is about 10 percent lower than in the 1999 report. Evidence supporting the lower forecast came from the CGPC, the NEB, and the AEUB.

downward by 3.7 Tcf/year, U.S. production diminished by 4.7 Tcf /year, and LNG imports increased by 2.4 Tcf/year. In addition, the AEO 2004 wellhead price forecast for 2015 has been increased by \$1.1 /MMBtu. Figure 5.3 below compares EIA forecasts for U.S. supply and production from the five most recent AEO reports (AEO 2000-2004). The figure clearly illustrates the EIA's recent downward revisions in forecasts for U.S. supply and production, as well as Canadian gas imports. By contrast forecasts for historically more expensive sources of natural gas supply such as Arctic gas<sup>10</sup> and LNG imports are substantially higher in the most 2004 AEO report.



**Figure 5.3: EIA Annual Energy Outlook natural gas supply forecasts**

### *Reasons for Recent Reductions in North American Supply Forecasts*

A number of factors contributed to the difference in supply and U.S. production forecasts between the 1999 and 2003 NPC reports. The four most critical factors were:

- A lower assessment of the technically recoverable resource base; see Section 2 for details. The primary factors leading to the reduction in assessed resource base were a lower reserve appreciation factor, a reduction in the ultimate recovery volume for undiscovered fields, and a slightly lower estimate of the unconventional gas resource base;<sup>11</sup>
- The weak marginal production response to the price/drilling run-up of 2000-01;

<sup>10</sup> In the 2004 EIA analysis, 4.5 Bcf/day of Arctic gas enters the market in the 2016-2018 time frame.

<sup>11</sup> Lower relative to EIA assessments.

- The rapidly maturing resource base, manifested by rapidly increasing well decline rates, and diminishing ultimate recovery volumes for new wells;
- A small net reduction in the forecasted technology improvement factor in the 2003 report.

### *Long-term Demand Forecasts*

From 1985 to about 1997 the North American natural gas market was demand limited, in other words there was enough spare production capacity to meet growing demand and to handle sudden increases in demand caused by periods of extreme weather. During this period prices were generally low and stable. From 1997 to 2000 North America transitioned to a supply limited natural gas market where supply and demand were tightly balanced. Excess production capacity became minimal and consequently prices have tended to be higher and more volatile.

The 1999 NPC and 2001 EIA supply and demand reports<sup>12</sup> forecast that only minor increases in price would be necessary to induce the development of significant new gas supplies. The two reports predicted continued strong growth in demand for natural gas, particularly in the power generation sector, through 2020. Essentially the NPC and EIA were forecasting the continuation of a demand limited natural gas market.

The “reassessment” of natural gas supply by the NPC and the EIA in 2003 and 2004 signaled the official acknowledgement<sup>13</sup> of the shift to a supply constrained market: See Section 2 for discussion of supply reassessment. The recent reassessment of U.S. supply has had a dramatic effect on demand forecast. The impact of constrained supply is particularly dramatic on the forecasts for the power generation and the industrial sectors.<sup>14</sup> Figure 5.4 below presents the NPC and EIA sector demand forecasts for 2010 and 2015. For the year 2015 forecast, the EIA reduced its estimate of natural gas demand by 10 percent in the industrial sector and by nearly 20 percent in the power generation sector.<sup>15</sup> Residential and commercial demand forecasts were revised downward only slightly. The NPC also made significant revisions in the sector demand forecasts between the 1999 and 2003 reports. Forecast demand for 2015 was reduced by 15 percent in the power generation sector and by 25 percent in the industrial sector. The 2003 NPC report essentially forecasts no demand growth in the industrial sector over the next 10 to 15 years.

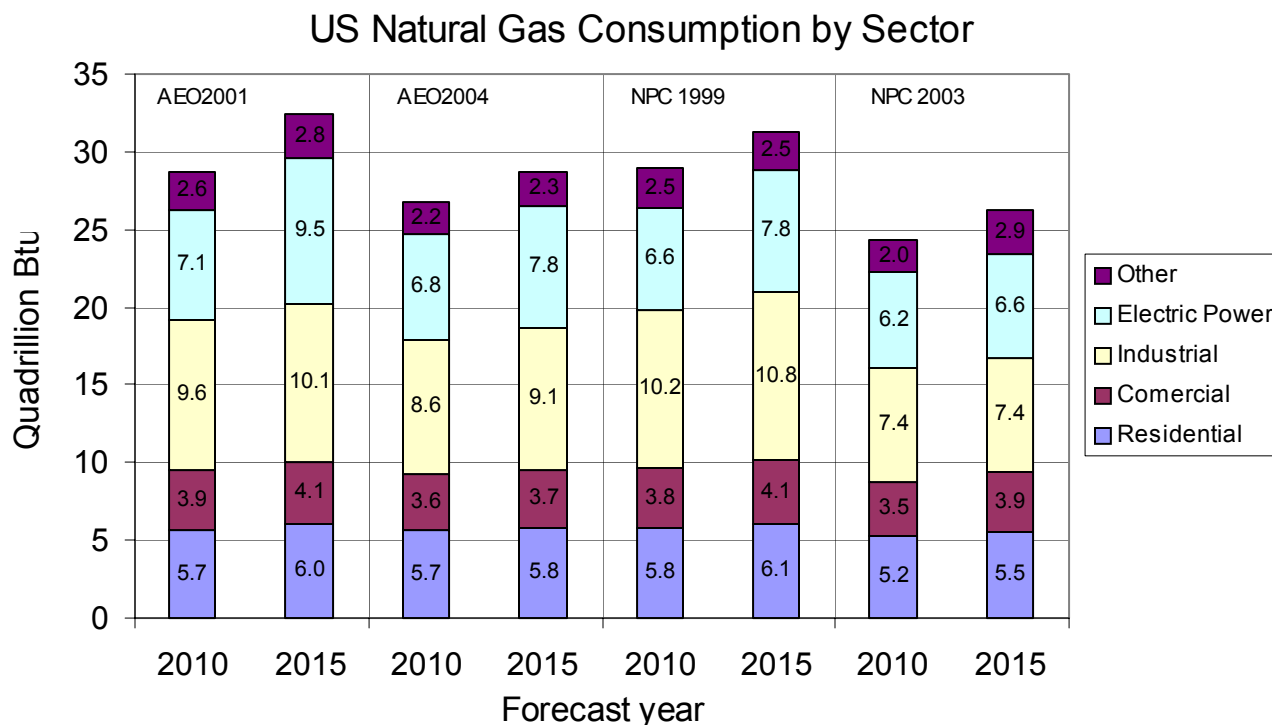
---

<sup>12</sup> In the 1990s energy consultants such as GRI also forecast robust growth in U.S. supply and demand

<sup>13</sup> Energy analysts such as Andrew Weisman (Energy Ventures Group), Mathew Simmons (Simmons & Company), and Daniel Yergin (CERA) gave warnings of changes in the natural gas market since 2001.

<sup>14</sup> Often when energy intensive businesses are faced with high gas prices they either switch fuels or relocate offshore.

<sup>15</sup> Comparing the AEO 2004 to the AEO 2001 report.



**Figure 5.4: EIA and NPC 2010 and 2015 forecasted natural gas consumption by sector**

### ***Demand Forecast for the Pacific Northwest***

The California Energy Commission (CEC) recently completed its *Natural Gas Market Assessment* (CEC, 2003), which was prepared as part of the CEC *Electricity and Natural Gas Report*. The primary focus of the natural gas market assessment was California, but the CEC also analyzed demand growth in the Pacific Northwest and for all Western states as defined by the Western Electricity Coordinating Council (WECC).

The CEC used the North American Regional Gas (NARG) model as its principal assessment tool. NARG is a general equilibrium model that predicts the prices (at five year intervals) necessary to balance supply and demand for a given scenario. The CEC released a draft of the *Natural Gas Market Assessment* in 2002 and a final report in August of 2003. Changing electricity and natural gas market conditions during the period 2001 through 2003, made it necessary for the CEC to update the demand forecast. Table 5.1 below illustrates the demand forecasts derived using the NARG model in 2002 and 2003.



**Table 5.1: CEC Natural gas demand growth forecasts for 2003-13**

<b>Forecast →</b>	<b>2003 demand (Tcf)</b>		<b>2008 demand (Tcf)</b>		<b>2013 demand (Tcf)</b>		<b>Annual growth 2003-13</b>	
Region and Sector	2002 report	2003 report	2002 report	2003 report	2002 report	2003 report	2002 report	2003 report
Pacific Northwest								
Electricity	0.17	0.18	0.27	0.23	0.42	0.27	9.15%	3.96%
All other sectors	0.46	0.42	0.50	0.45	0.49	0.48	0.51%	1.51%
Subtotal	0.63	0.60	0.77	0.67	0.90	0.75	3.56%	2.31%
California								
Electricity	0.66	0.80	0.74	0.89	0.82	0.93	2.22%	1.54%
All other sectors	1.61	1.40	1.79	1.46	1.94	1.50	1.87%	0.67%
Subtotal	2.27	2.20	2.52	2.35	2.76	2.43	1.98%	0.99%
Western States								
Electricity	1.23	1.46	1.70	1.93	2.12	2.03	5.60%	3.36%
All other sectors	2.98	2.61	3.33	2.78	3.59	2.93	1.88%	1.16%
Total	4.21	4.07	5.04	4.71	5.71	4.97	3.10%	2.00%

Source: CEC 2003

Table 5.1 illustrates several interesting points about the 2003-2013 West Coast natural gas demand forecasts. First, there has been a sizable reduction in the forecasted demand growth between the CEC's 2002 and 2003 analyses: 3.1 percent overall annual demand growth is reduced to 2 percent for the Western states region. The relative decrease in demand growth is even larger for the electrical generation sector: 35 percent *relative* reduction in the forecast of overall gas demand growth versus a 40 percent *relative* reduction in the electrical generation sector demand growth. Note that the reduction in the 2003-13 forecast for Pacific Northwest annual electrical generation demand growth, which was reduced from 9.15 to 3.96 percent, is the largest. This drop in demand growth is in part attributable to the permanent loss of the aluminum smelting industry, which was not fully factored into the 2002 report. Finally, the share of West Coast natural gas consumption devoted to electrical generation is forecast to rise considerably over the next 10 years from 29 percent of consumption in 2003 to 41 percent of consumption in 2013. For the Pacific Northwest, gas consumption in the electrical generation sector rises from 27 percent to 36 percent of overall gas consumption.

### Summary

The EIA and NPC have recently revised downward their natural gas forecasts for U.S. supply and production. The EIA revised estimated supply and demand for year 2015 down by 11 percent, U.S. production down by 18 percent, and LNG imports upward by nearly a 280 percent. The NPC revised year 2015 supply down by 16 percent, U.S. production down by 26 percent, and LNG imports upward by nearly 270 percent. The primary reasons for the significant changes in the supply and production forecasts are:

1. A lowered assessment of the technically recoverable natural gas resource base;
2. Weak marginal production response to the price/drilling run up of 2000-01;
3. Mounting evidence that the North American gas resource base is mature, and growth potential is limited;
4. The gas resources replacement cost is more than assumed in the earlier studies;

5. LNG is now price competitive with domestically produced natural gas in many parts of the United States.

Downward revisions in forecast U.S. demand parallel the downward supply and production revisions. The largest revisions are in the industrial and power generation sectors. Part of the forecast reduction in demand is due to price induced efficiency and conservation. Demand destruction accounts for much of the reduction in industrial sector demand growth.

The CEC recently re-evaluated its natural gas demand growth forecast for the West Coast, including the Pacific Northwest. For the Pacific Northwest, the forecast gas demand growth in the electrical generation sector was decreased by more than 50 percent, while overall gas demand growth was reduced by 35 percent.

In hindsight, the early NPC (1999) and EIA (2001) natural gas reports were overly optimistic about the expansion of United States and overall North American natural gas supply. They may have had the unfortunate effect of encouraging higher levels of current and planned future consumption on the basis that natural gas would remain a plentiful and relatively inexpensive energy source. This may be especially true in the power generation sector where utilities and developers between 1998 and 2004 have added over 200 Giga-watts of gas-fired generating capacity at a capital cost of over 100 billion dollars. These optimistic reports, which forecast ample supply and low gas prices from 2000 to 2015, may have also delayed by many years the development of what were then thought to be uneconomical natural gas supply sources such as LNG and Arctic natural gas. The “rosy” gas supply scenarios put forth by the NPC and EIA may also have delayed development of what have now become cost competitive renewable and efficiency programs.